April 12, 1883.

THE PRESIDENT in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

I. "The Principal Cause of the Large Errors at present existing between the Positions of the Moon deduced from Hansen's Tables and Observation: and the Cause of an Apparent Increase in the Secular Acceleration in the Moon's Mean Motion required by Hansen's Tables, or of an Apparent Change in the Time of the Earth's Rotation." By E. J. STONE, F.R.S., Director of the Radcliffe Observatory, Oxford. Received April 3, 1883.

(Abstract.)

The errors in the Lunar Theory have been traced to the effects of changes in *the unit of time*, which have, apparently unconsciously, been introduced from time to time into astronomy, with changes in the adopted data.

The argument is clearly seen by a consideration of the different expressions for the longitudes of, what may be called, the mean sun, which have been adopted for the determination of the sidereal times at mean noon.

If B, H, and V denote the longitudes of the mean sun, according to Bessel, Hansen, and Le Verrier, we have for 1850, January 1, Paris mean noon, t.

$$B = 280^\circ\ 46'\ 36''{\cdot}12 + 1296027{\cdot}618184\ .\ t + 0{\cdot}0001221805\ .\ t^2.$$

$$H = 280^\circ\ 46'\ 43''{\cdot}20 + 1296027{\cdot}674055\ .\ t + 0{\cdot}0001106850\ .\ t^2.$$

$$V = 280^\circ\ 46'\ 43''{\cdot}51 + 1296027{\cdot}678400\ .\ t + 0{\cdot}0001107300\ .\ t^2.$$

In all these expressions the unit of time has been *supposed* to be a Julian year of 365·25 mean solar days.

The constant differences $7''{\cdot}08$ and $7''{\cdot}39$ in B−H and B−V are not unimportant, for they introduce abrupt changes in the record of time; but the differences in the coefficients of t and t^2 show that the *same* unit of time cannot have been adopted in these expressions.

The measure of time must be continuous, let, therefore, 1 and $(1+x)$ be the units in B and H,

then $1296027{\cdot}618184\,.\,t+0{\cdot}0001221805\,.\,t^2$
$$=1296027{\cdot}674055\,.\,t(1+x)+0{\cdot}0001106850\,.\,t^2(1+x)^2.$$

If, therefore, $n=1296027{\cdot}674055$,

$$x=-\frac{0{\cdot}055871}{n}+\frac{0{\cdot}000114955\,.\,t}{n}.$$

To reconcile B and H, therefore, x must contain a variable term. Similar remarks apply to the difference between B and V.

Now, let N be the moon's mean motion referred to 1 as the unit of time, and $(\mathrm{N}+\delta\mathrm{N})$ the moon's mean motion referred to $(1+x)$ as the unit of time,

then $$(\mathrm{N}+\delta\mathrm{N})(1+x)=\mathrm{N},$$

and

$$t\,.\,\delta\mathrm{N}=\frac{\mathrm{N}}{n}\{0{\cdot}055871\,.\,t-0{\cdot}0000114955\,.\,t^2\}=0''{\cdot}747\,.\,t-1''{\cdot}54\left(\frac{t}{100}\right)^2.$$

But Hansen determined his mean motion of the moon so as to force an agreement between his theory and observations reduced with Bessel's unit 1; and his tables, therefore, represented the observations well for many years whilst 1 was adopted as the unit of time; but directly the unit of time was changed by the adoption either of H or V, then the effects of the erroneous determination of the moon's mean motion by Hansen became apparent. The change of error in longitude of Hansen's Lunar Tables between 1864, when Le Verrier's Solar Tables were adopted in the Nautical Almanac, and 1880 amounts to more than $10''$.

The effect of the change of unit is also shown in the comparison of Le Verrier's Solar Tables with observation, but, of course, only to about the thirteenth part of the amount shown by the Lunar Tables.

The necessity of adopting some definite unit of time, by fixing the constants in the expression for the longitude of the mean sun, is insisted upon.

If $\mathrm{L}_0+n_0t+s_0t^2$ is the expression adopted for the longitude of the mean sun, the quantities L_0, n_0, s_0 must never be changed. The correction $\delta\mathrm{L}$, which from time to time may appear necessary to obtain the mean longitude of the sun from the longitude of the mean sun, must not be allowed to change the adopted values of L_0, n_0, and s_0. The true longitude of the sun will then

$$=\mathrm{L}_0+n_0t+s_0t^2+\delta\mathrm{L}+\text{Periodic terms}.$$

It would appear that speculations respecting changes in the time of

rotation of the earth on its axis are at least premature, until the theories have been revised with a unit of time freed from changes of adopted constants, which are at present inextricably mixed up with any effects which would result from a change in the time of rotation of the earth on its axis.

II. "On the Atomic Weight of Glucinum (Beryllium)." By T. S. HUMPIDGE, Ph.D., B.Sc. Communicated by Professor FRANKLAND, F.R.S. Received March 20, 1883.

(Abstract.)

In this paper the author shows that no conclusions with respect to the atomic weight of glucinum can be drawn from analogy of its compounds with those of other metals, and that this long-disputed question can only be decided by the specific heat of the metal or by the vapour-density of some of its volatile compounds. Two determinations of the specific heat have been made by Professor E. Reynolds and by M. Nilson, the former of whom obtained a result of about 0·6, and the latter only about 0·4. The probable inaccuracies in Professor Reynolds' apparatus are pointed out, and it is shown that his metal was probably impure.

The author has prepared metallic glucinum from the chloride, the vapour of which was passed over sodium contained in iron boats in a glass tube. A metal was thus obtained which had the composition :—

Gl	93·97
Gl_2O_3	4·71
Fe	1·32
Si	traces.
	100·00

and was probably the purest yet prepared.

The specific heat was determined by a modification of Regnault's method of mixtures, using electrical appliances to avoid the necessity of an assistant. Three determinations of the specific heat of silver in water, made to test the apparatus, gave the following results :—

I	0·05677
II	0·05568
III	0·05553
Mean	0·05600

and with a mean error of 1 per cent. The specific heat of metallic